

REJECTIONS UNDER 35 U.S.C. § 112, SECOND PARAGRAPH

Claims 1-13 were rejected as being indefinite for the recitation in claim 1 of "aromatic type material." Claim 1 has been amended in accordance with the Examiner's suggestion. Furthermore, claims 8-12 have been amended to clarify any indefinite language. Support for these amendments is found in the specification and claims as filed. Withdrawal of these rejections is respectfully requested.

REJECTIONS UNDER 35 U.S.C. § 103(a)

Claims 1-13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Number 3,929,617 issued to Henry et al. (hereafter referred to as "Henry et al."). Applicants respectfully traverse this rejection as it would not have been obvious to one of ordinary skill in the art to arrive at the present invention as claimed from the disclosure of Henry et al.

Specifically, Henry et al. is directed towards a different objective than that achieved by the present invention, and thus does not disclose or suggest the present invention as claimed. The primary objective of the present invention is to facilitate phase separation and thereby increase the yield of raffinate. Applicants have achieved the present invention by using a mixture of furfural and a co-solvent selected from one or more aliphatic amides having less than 5 carbon atoms. In contrast, the objective of Henry et al. is to remove aromatics from hydrocrackate, by the use of a solvent. There is no teaching or suggestion by Henry et al. regarding the facilitation of the phase separation and thereby increasing the yield of raffinate. Henry et al. very clearly states that the main object of the invention was to increase the VI and UV stability of the lubricating oil and not increase the yield of raffinate.

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While Henry et al. provides a process for producing high VI, UV stable lubricating oil products, the present invention provides a process to increase the yield of the raffinate product at the same VI which is only possible by employing the furfural-aliphatic amide mixture solvent in the disclosed ratio. Increasing the raffinate product at the same VI is not possible through the solvent extraction process taught by Henry et al., regardless of the solvent mixture disclosed.

Henry et al. discloses a process for solvent extraction of aromatics only from hydrocrackate and not directly from the hydrocarbon oil as claimed in claim 1. It <sup>(2)</sup> should be noted that in Henry et al., the hydrocarbon oil (lubricating oil) acts as feedstock for the step of hydrocracking and not as the feedstock for solvent extraction process (see Claim 1, lines 48 to 53, step (a), and Col. 1, lines 63-65). However, in the present invention, the hydrocarbon oil (lubricating oil) containing aromatics is directly used as feedstock for the solvent extraction process. Thus, Henry et al. teaches a different starting material than that used in the present invention. <sup>3</sup>

While the Office Action acknowledges that Henry et al. does not specifically disclose that the solvent is a mixture of furfural and an aliphatic amide (page 4), the Office Action alleges that it would have been obvious to select the claimed solvents from a list of solvents disclosed by Henry et al. Applicants respectfully disagree. Henry et al. provides a general recitation of all the solvents known at that time for solvent extraction of aromatics, and does not provide any <sup>4</sup> examples that suggest that use of furfural and an aliphatic amide in combination increases the yield of raffinate as is clearly shown in the present invention. By merely reciting a laundry list of extraction solvents, Henry et al. has not rendered the process as claimed obvious.

The Office Action further states that it would be obvious to a person of ordinary skill in the art to have modified the process of Henry et al. by using furfural and dimethylformamide. This conclusion appears to be based solely on hindsight reconstruction of the present invention and not based on material facts available in Henry et al. Even if a person of ordinary skill in the art were motivated to select the particular combination of furfural and dimethylformamide, he would have first cracked the lubricating oil by passing the same along with hydrogen through a hydrocracking zone maintained at a pressure ranging between 400 psig and 1000 psig at temperature ranging between 650°C and 750°C in the presence of a hydrocracking catalyst to obtain a hydrocrackate product and thereafter only would have performed the process of solvent extraction on the hydrocrackate product. S

A person of ordinary skill in the art would not be motivated to perform the process of solvent extraction directly on the lubricating oil. Therefore, the process of the present invention would not be obvious to a person of ordinary skill in the art.

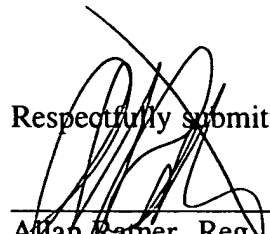
Furthermore, Henry et al. teaches the use of an anti-solvent in combination with the solvent during the step of solvent extraction. Each of the Henry et al. examples teach the use of phenol (solvent) with water (an anti-solvent) for solvent extraction of hydrocrackate. However, Applicants have proceeded in spite of the teachings of Henry et al. and have not used an anti-solvent in the present invention. Applicants note that co-solvent and anti-solvent have diagonally opposite effect in the solvent extraction process. A co-solvent enhances the phase separation and power of the main solvent whereas the anti-solvent decreases the phase separation capabilities of the main solvent. Hence, Henry et al. and the present invention are conceptually opposite, and a person of ordinary skill in the art would not arrive at the present invention in view Henry et al. S

Regarding claim 7 and the Office Action comments alleging that it would be obvious to one of ordinary skill in the art to have modified the process of Henry et al. by using the claimed ratio of furfural and dimethylformamide, the present invention is directed towards a specific process wherein a mixture of furfural and aliphatic amide in the ratio of 70:30 to 95:5 is used for solvent extraction. In contrast, Henry et al. provide only a generic recitation of all the solvents known for use in solvent extraction of aromatics. Henry et al. does not disclose an example in which furfural is the solvent for a solvent extraction process, let alone a furfural-aliphatic amide mixture. Henry et al. merely provides a generic recitation of any mixture of all the solvents. Henry et al. provides no data whatsoever on a furfural/amide mixture. Accordingly, without additional guidance or motivation, it would not be obvious for a person skilled in the art to arrive at the particular combination of furfural and aliphatic amide in the ratio of 70:30 to 95:5 as described in the present invention. 7

The rejections under 35 U.S.C. §§ 112 and 103 and the objections should all be withdrawn. Favorable action is earnestly solicited. Finally, the Examiner is invited to call Applicants' undersigned representatives if any further amendment will expedite the prosecution of the application or if the Examiner has any suggestions or questions concerning the application or the present Response. In fact, if the claims of the application are not believed to be in full condition for allowance, for any reason, Applicants respectfully request the constructive assistance and suggestions of the Examiner in drafting one or more acceptable claims pursuant to MPEP § 707.07(j) or

in making constructive suggestions pursuant to MPEP § 706.03 so that the application can be placed in allowable condition as soon as possible and without the need for further proceedings.

Respectfully submitted,

  
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Enc - Version with markings to show changes made

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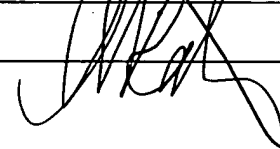
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**VERSION WITH MARKINGS TO SHOW CHANGES MADE****IN THE CLAIMS:**

1                    1.     (Amended) An improved furfural extraction process for the  
2 extraction of aromatic ~~type~~ material from a hydrocarbon oil containing aromatic  
3 material, said process comprising contacting, in a unit, the hydrocarbon oil with a  
4 solvent comprising of furfural and a co-solvent selected from one or more aliphatic  
5 amides having less than 5 carbon atoms, to obtain increased raffinate yield by  
6 facilitating phase separation, while maintaining the same product quality as measured  
7 by raffinate refractive index.

1                    8.     (Amended) A process as claimed in claim 1, wherein the yield of  
2 raffinate increases ~~by more than 3 vol. %~~ between 3 vol. % and 15 vol. % with the  
3 addition of the co-solvent compared to a furfural extraction process without the  
4 addition of the co-solvent.

1                    9.     (Amended) A process as claimed in claim 1, wherein the yield of  
2 raffinate increases ~~by more than 5 vol. %~~ between 5 vol. % and 10 vol. % with the  
3 addition of the co-solvent compared to a furfural extraction process without the  
4 addition of the co-solvent.

1                    10.    (Amended) A process as claimed in claim 1, wherein the solvent  
2 dosage is ~~less than 250 vol. %~~ between 30 vol. % and 250 vol. % of the feedstock.

1                    11.    (Amended) A process as claimed in claim 1, wherein the solvent  
2 dosage is ~~less than 180 vol. %~~ between 50 vol. % and 180 vol. % of the feedstock.

- 1                    12.    (Amended) A process as claimed in claim 1, wherein the solvent  
2    dosage is ~~less than 150 vol. %~~ between 80 vol. % and 150 vol. % of the feedstock.